Journal of Pediatric Surgery 52 (2017) 469–472

Contents lists available at ScienceDirect

Journal of Pediatric Surgery

journal homepage: www.elsevier.com/locate/jpedsurg

Bladder continent catheterizable conduit (the Mitrofanoff procedure): Long-term issues that should not be underestimated

Alice Faure [a,*,1], Rebecca Cooksey [a,1], Aurore Bouty [a], Alan Woodward [a], John Hutson [a,b], Mike O'Brien [a], Yves Heloury [a]

[a] Royal Children's Hospital, Department of Paediatric Urology, Melbourne, Australia
[b] FD Stephens Surgical Research Group, Murdoch Childrens Research Institute, Department of Paediatric Urology, Melbourne, Australia

ARTICLE INFO

Article history:
Received 11 April 2016
Received in revised form 5 September 2016
Accepted 7 September 2016

Key words:
Urology
Mitrofanoff
Continent catheterizable conduit

ABSTRACT

Background: Effective bladder emptying by clean intermittent catheterization for children with severe bladder dysfunction is critical for renal preservation and social integration. Use of a continent catheterizable conduit (CCC) as urethral alternative procedure provides effective bladder drainage. However, it brings a substantive maintenance.
Methods: Retrospective review of the indications and long-term outcomes of 54 patients with a Mitrofanoff procedure in a single center over a 20-year period (1995–2015).
Results: Indications of CCC include 21 neurogenic bladders, 12 patients with epispadias/exstrophy, 13 bladder outlet obstruction, 6 malignancies and 2 cloaca. Median age at surgery was 8.3 years (4 months–20 years). The appendix was used in 76% of cases. Most frequently encountered complication was stomal stenosis (n = 17/34, 50%), occurring at median time of 9 months (2 months–13 years). The other complications were: leakage in 9 (26.5%); conduit stricture in 5 (14.7%), angulation of the conduit in 2 (5.8%) and prolapse in one (3%). Operative revision was encountered by 33 (61%) patients, the majority in the first 2 years. Median follow-up was 4.3 years (3 months–16 years).
Conclusions: CCC has a high incidence of complication. It has to be used only when the native urethra is not suitable for catheterization. Carers, patients and families must be prepared to deal with both the complexity of index conditions and the complications of this procedure.

Initially introduced by a French pediatric surgeon, Paul Mitrofanoff, in the eighties, the continent catheterizable conduit (CCC) using appendix (or other tubular structure such as ureter, intestinal segment, etc) had revolutionized the treatment of patients who need lower urinary tract reconstruction [1]. CCC gives access to the bladder when the bladder neck is closed or when the urethra is difficult to catheterize (neurogenic bladder and orthopedic deformities, exstrophy-epispadias, posterior urethral valves). Even though CCC creation had decreased the number of non-continent urinary diversion in the pediatric population, the complication rate of this innovative procedure remains significant.

Most common complications are stomal stenosis or leak [2,3]. The surgical correction of each of these problems poses a substantial difference in intervention. The former needing a suprafascial procedure, such as dilatation or skin revision, the latter requiring further investigation as to volume-pressure dynamics and possible deep surgery for conduit revision or reimplantation.

The aim of this study was to report our experience of CCC with a focus on the indications and surgical revision.

1. Materials and methods

Between 1995 and 2015, we retrospectively reviewed all the cases of CCC at a single referral center for pediatric urology.

The surgical technique was similar to the Mitrofanoff description with implantation of the appendix (or other tubular structure) between the bladder and the skin [1]. The bladder implantation was continent by creation of a sub-mucosal conduit by an extra-vesical approach (Lich-Gregoir) or by an intravesical approach (Leadbetter-Politano), depending on associated procedures such as bladder augmentation. The skin implantation was done in the belly button or in the right iliac fossa with a Y-V or VQZ plasty. The umbilical stoma was created using a V-flap with spatulation of the intestinal conduit (in the superior border of the skin and on its posterior surface of the intestinal conduit) after detaching the umbilicus from the rectus sheath. Patients had a suprapubic catheter and indwelling catheter in the Mitrofanoff left on free drainage during 21 days. Once CIC was established, the suprapubic catheter was removed.

* Corresponding author at: Department of Urology, Royal Children's Hospital, Melbourne, 50 Flemington Road, Parkville, VIC 3052, Australia. Tel.: +61 3 9345 5800; fax: +61 3 9345 6668.
E-mail address: alice.faure@ap-hm.fr (A. Faure).
[1] Contributed equally.

http://dx.doi.org/10.1016/j.jpedsurg.2016.09.054
0022-3468/

None of them had a laparoscopic approach to perform the CCC creation.

Following approval by our institutional research ethics board, we reviewed the electronic medical records of children who underwent CCC. Surgical indications included inability to perform catheterization per urethra because of intact sensation, difficult or impossible access through the native urethra. Concomitant bladder augmentation was offered to children with low bladder capacity with poor detrusor compliance. Data collected included demographic data, age at surgery, underlying diagnosis, concurrent bladder neck reconstruction or closure, site for stoma creation, tissue used, complications rates, number and indication for surgical revision, type of surgical revision, duration of follow up and outcomes. Conduit complications were divided into superficial stomal problems, which required surgery at the skin level only (suprafascial revision) and deep complications, which required laparotomy (infrafascial revision). Patients >20 years of age and those who had surgery outside our institution or incomplete medical records were excluded from the study.

Statistical analyses were carried out with commercially available software (GraphPad Prism™). When appropriate, the data are presented as the number and percentage, as the mean +/− standard deviation (SD), or as the median and range. The comparison between two groups for qualitative variables were done using the chi square test or Fisher's exact test.

A p value of <0.05 was considered statistically significant.

2. Results

Over a 20-year-period, 66 children were identified with 12 subsequently excluded (CCC creation outside our institute: n = 8 and insufficient data: n = 4). Thirty-two boys and 22 girls underwent surgery at a median age of 8.3 years (ranged from 4 months to 20 years). Underlying diagnosis included neurogenic bladder (n = 21, 38.8%), bladder exstrophy-epispadias complex (n = 12, 24%), posterior urethral valves (n = 9, 16.6%), and other (n = 12, 20%) (Table 1). The CCC was the appendix in 41 cases (76%), an ileal Monti tube in 6 (11%), a ureteral tube in 5 (9.2%), a tubularized colon flap and a Boari flap in 1. Associated procedures were done in 22 cases (37%), including 14 bladder augmentations (26%), 5 bladder neck closures (9%) and 1 bladder neck reconstruction. In 44 (81%) cases, the stoma was located in the umbilicus and in 10 (18.5%) cases in the right lower quadrant.

The overall median length of follow-up was 4.3 years (ranged from 3 months to 16 years). Two patients were lost of follow-up 3 years after surgery and 7 patients were transitioned to adult urology clinics.

Table 1
Indications of CCC.

Neurogenic bladder	n = 21 (39%)
•Spina bifida	
○Ambulant	4
○Non-ambulant	5
•Sacral agenesis, caudal regression	6
•Sacrococcygeal teratoma	1
•Idiopathic	5
Epispadias-exstrophy complex	n = 12 (22%)
•Epispadias	1
•Bladder exstrophy	10
•Cloacal exstrophy	1
Bladder outlet obstruction	n = 13 (24%)
•Posterior urethral valves	9
•Non PUV	4
Other	n = 8 (14.8%)
•Lesch–Nyhan syndrome	1
•Rhabdomyosarcoma	4
○vagina	
○prostate	
•Cloaca	2
•Hypospadias	1

Postoperative complications were reported in 34 cases (63%). All patients who underwent a transverse ileal tube (n = 3/3), a ureteral (n = 5/5) or colonic Mitrofanoff (n = 1/1) developed postoperative complications compared with 61% (n = 25/41) when the appendix was used. According to the underlying diagnosis, 78% (n = 7/9) of PUV patients had a complications compared with 66.7% (n = 14/21) for the group with neurogenic bladder ($p = 0.68$), 58% (n = 7/12) in the "other" group and 42% (n = 5/12) in bladder exstrophy. Fifty percent (n = 11/22) of patients who underwent CCC creation combined with other surgery had a complication versus 72% (n = 23/32) in the group of patient who had the conduit creation alone. According to the site of the stoma creation, 40% (n = 10/40) of patients with a VQZ developed a complication compared with 68% (n = 30/44) in the umbilical stoma group.

Stomal stenosis at the skin level occurred in 17 patients (50%, n = 17/34) at a median time of 9 months (ranged from 2 months to 13-years). Stomal stenosis was more frequently encountered when the appendix (n = 12/17) was used compared with bowel segment (n = 4/17). However, the appendix segment narrowed less frequently than bowel segment (29% 12/41 vs. 100% 3/3 for ileum and 1/1 for colon). Thirteen children needed a surgical stoma revision (Y-V plasty) and were successfully treated. In 4 cases, the stenosis was managed by autodilatations. The incidence of stomal stenosis in the different indications is reported in the Fig. 1. Difficulty with catheterizing the conduit has been related to angulation of the channel in 2 (5.8%, n = 2/34) patients. Stricture of the conduit developed in 5 patients (14.7%, n = 5/34). They all required an open operative revision (dilatation and catheter for 3 weeks in two cases; new CCC with ileum in three).

Stomal prolapse developed in one (3%, n = 1/34) patient who required a single operative revision to fix it and no recurrence was noted.

Nine patients (26.5%, n = 9/34) complained of intermittent leakage. Despite increasing the number of catheterization at daytime and high doses of anticholinergic, seven needed endoscopic injection of bulking agents. Only one patient reported persistent episodes of leakage after two injections. No perforation of the CCC was reported.

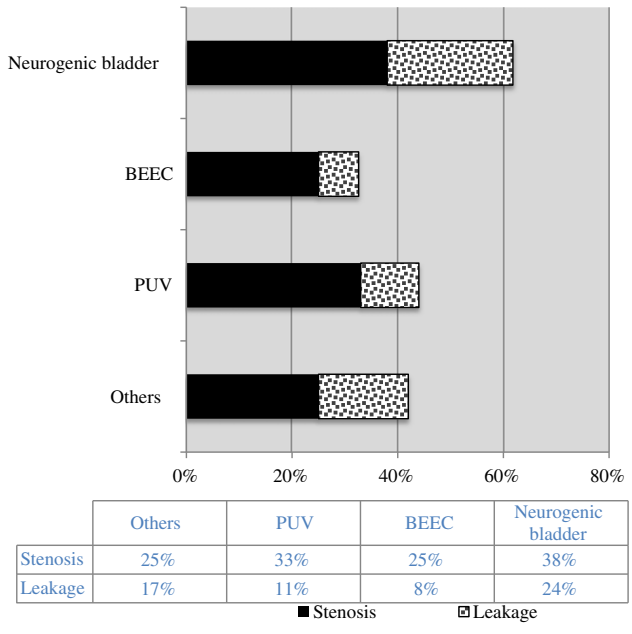

Fig. 1. Bar graph with the distribution of stomal stenosis (n = 17) and leakage (n = 9) rate based on underlying diagnosis. BEEC, bladder exstrophy-epispadias complex. PUV, posterior urethral valve. Others included Lesch–Nyhan syndrome, Rhabdomyosarcoma, cloaca, hypospadias, urethra atresia, and prune-belly. There were no significant differences in stoma stenosis rate between patients with a neurogenic bladder and with a history of PUV ($p = 0.53$).